

## Claims

- [c1] 1. A chemical stripping method for selectively removing a diffusion aluminide coating from a substrate, comprising the step of contacting the coating with an aqueous composition comprising at least one acid having the formula  $H_xZrF_6$ , or precursors to said acid, wherein x is 1–6.
- [c2] 2. The method as recited in claim 1, wherein x is 1–3.
- [c3] 3. The method as recited in claim 1, wherein the acid is present at a concentration in the range of about 0.05 M to about 5 M.
- [c4] 4. The method as recited in claim 3, wherein the acid is present at a concentration in the range of about 0.5 M to about 3.5 M.
- [c5] 5. The method as recited in claim 1, wherein the precursor is a salt of the acid.
- [c6] 6. The method as recited in claim 1, wherein the aqueous composition comprises the compound  $H_2ZrF_6$ .
- [c7] 7. The method as recited in claim 6, wherein the  $H_2ZrF_6$  compound is formed in situ within the aqueous composition, by the dissociation of a corresponding salt of the compound; or by the reaction of a zirconium-containing compound with a fluorine-containing compound.
- [c8] 8. The method as recited in claim 7, wherein the zirconium-containing compound is  $ZrO_2$ , and the fluorine-containing compound is HF.
- [c9] 9. The method of claim 1, wherein the substrate is immersed in a bath of the aqueous composition.
- [c10] 10. The method of claim 9, wherein the aqueous composition is maintained at a temperature in the range of room temperature to about 100 ° C.
- [c11] 11. The method of claim 10, wherein the aqueous composition is maintained at a temperature in the range of about 30C to about 85C.
- [c12] 12. The method of claim 10, wherein the substrate is immersed in the aqueous composition for a time period in the range of about 1 minute to about 10 hours.



- [c24] 24. The method as recited in claim 23, wherein the abrasion is carried out by a grit-blasting technique.
- [c25] 25. A chemical stripping method for selectively removing a diffusion platinum-aluminide coating from a superalloy substrate, comprising the step of treating the substrate with an aqueous composition comprising at least one acid having the formula  $H_xZrF_6$ ; wherein x is 1-6.
- [c26] 26. The method of claim 25, wherein the substrate is treated with the aqueous composition in a bath, for a period of time sufficient to remove an overlying additive sublayer of the coating, while not substantially removing an underlying diffusion sublayer of the coating.
- [c27] 27. The method of claim 26, wherein the substrate is a turbine component or combustor component of a gas turbine engine.
- [c28] 28. A method for replacing a worn or damaged diffusion aluminide coating applied over a substrate, comprising the following steps:  
 (i) chemically removing the worn or damaged coating by contacting the substrate with an aqueous composition, wherein the aqueous composition comprises an acid having the formula  $H_xZrF_6$ , where x is 1-6, or precursors to said acid; and then  
 (ii) applying a new coating over the substrate.
- [c29] 29. The method of claim 28, wherein the diffusion aluminide coating comprises a diffusion sublayer which lies over the substrate, and an additive sublayer which lies over the diffusion sublayer.
- [c30] 30. The method of claim 29, wherein the additive sublayer is removed, while the diffusion sublayer is substantially unaffected.
- [c31] 31. The method of claim 28, wherein the new coating is a diffusion-aluminide coating or an overlay coating.
- [c32] 32. The method of claim 31, wherein the overlay coating comprises a composition of the formula  $MCrAl(X)$ , where M is an element selected from the group consisting of Ni, Co, Fe, and combinations thereof; and X is an element selected from the group consisting of Y, Ta, Si, Hf, Ti, Zr, B, C, and combinations thereof.

- [c33] 33. An aqueous stripping composition for selectively removing a diffusion aluminide coating from a substrate, comprising an acid having the formula  $H_xZrF_6$ , where x is 1-6, or precursors to said acid, wherein the acid is present in the composition at a concentration in the range of about 0.5 M to about 3.5 M.
- [c34] 34. The stripping composition of claim 33, further comprising at least one additive selected from the group consisting of inhibitors, dispersants, surfactants, chelating agents, wetting agents, deflocculants, stabilizers, anti-settling agents, and anti-foam agents.
- [c35] 35. The stripping composition of claim 33, in which a gas turbine engine component is immersed.